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UNITED STATES PATENT AND TRADEMARK OFFICE
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Examiner: Group: Attorney Docket # 1956

Applicant(s) : WILD, E., ET AL

Serial No. :

Filed :

For : METHOD, COMPUTER PROGRAM AND
APPARATUS FOR MONITORING A NEGATIVE-
PRESSURE DEVICE

SIMULTANEOUS AMENDMENT

April 1, 2002

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

SIRS:

Simultaneously with filing of the above identified application
please amend the same as follows:

In the Claims:

Cancel all claims without prejudice.

Substitute the claims attached hereto.

REMARKS:

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicant has amended the claims so as to eliminate their multiple dependency.

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,


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Reg. No. 27233

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Claims

1. A method for monitoring a vacuum device of a pneumatically operated servo unit of a motor vehicle, in which an electric suction pump (28) exerts vacuum on a vacuum chamber (22), characterized in that
 - a) a starting pressure in the vacuum chamber (22) is determined;
 - b) after a predetermined time interval, an ending pressure in the vacuum chamber (22) is determined;
 - c) the difference between the ending pressure and the starting pressure is calculated and is compared to a limit value;
 - d) when this difference falls below the limit value, a signal is generated.
2. The method according to claim 1, characterized in that the limit value is determined as a function of the starting pressure in the vacuum chamber (22).
3. The method according to [one of claims 1 or 2] claim 1, characterized in that the limit value is determined as a function of the ambient pressure.
4. The method according to [claims 2 and 3] claim 2, characterized in that the limit value is determined as a function of the difference between the ambient pressure and starting pressure.
5. The method according to [one of the preceding claims] claim 1, characterized in that the starting pressure is determined as soon as the suction pump (28) is switched on.

6. The method according to [one of the preceding claims] claim 1, characterized in that the signal generated triggers a control or alarm device.

7. The method according to claim 6, characterized in that the triggering of the control or alarm signal is suppressed if at least one of the following conditions is fulfilled:

- a) the pressure in an intake tube (12) of an internal combustion engine, which intake tube is connected to the vacuum chamber (22), is lower than the pressure in the vacuum chamber (22);
- b) the servo unit (30) is actuated; and/or
- c) the pressure in the vacuum chamber (22) is lower than the minimal possible pressure in the electric suction pump (28) plus a threshold value.

8. A computer program, characterized in that it is suitable for executing the method according to [one of claims 1 to 7] claim 1 when it is run on a computer.

9. The computer program according to claim 8, characterized in that it is stored in a memory, in particular a flash memory.

10. An apparatus for monitoring a vacuum storage device (41) of a pneumatically operated servo unit (30) of a motor vehicle, with a vacuum chamber (22), which is fluid-connected to an electric suction pump (28) and can be acted upon with a vacuum, characterized in that

- a) it detects a starting pressure in the vacuum chamber (22);

- b) after a certain time interval, it detects an ending pressure in the vacuum chamber (22);
- c) it calculates the difference between the ending pressure and the starting pressure and compares this to a limit value; and
- d) when this difference falls below the limit value, it generates a signal.

11. The apparatus according to claim 10, characterized in that it includes:

- a) means (34) for determining the pressure in the vacuum chamber (22);
- b) means (46) for detecting the beginning of an evacuation process;
- c) a timer (54), which determines the time elapsed since the beginning of the evacuation process;
- d) means (52) for storing the starting pressure at the beginning of the evacuation process;
- e) a subtraction circuit (60), which calculates the difference between the starting pressure and the current pressure in the pressure chamber (22);
- f) two set point generators (56, 66), one of which predetermines a time interval and the other of which predetermines a minimal value for the difference between the starting pressure and the current pressure in the pressure chamber (22); and
- g) a comparator (62), which generates a signal if the difference is less than the minimal value after the passage of the time interval.

12. The apparatus according to claim 11, characterized in that the means (46) for detecting the beginning of an evacuation process include a device, which detects a signal edge that represents the response of the pump (28).

13. The apparatus according to [one of claims 10 to 12] claim 10, characterized in that it includes a calculation circuit (64), which is connected on the input side to the means for storing the starting pressure and/or means for detecting the ambient pressure, and in which a function is processed so that the limit value is determined as a function of the starting pressure, the ambient pressure, and/or the difference between the starting pressure and the ambient pressure.

14. The apparatus according to [one of claims 10 to 13] claim 10, characterized in that it has a signal generator (68), which triggers a control and/or alarm signal when the signal is generated by the comparator (62).

15. The apparatus according to claim 14, characterized in that it includes means (70), which suppress the generation of a control or alarm signal if at least one of the following conditions is fulfilled:

- a) the pressure in an intake tube (12) of an internal combustion engine (10), which intake tube is connected to the vacuum chamber (22), is lower than the pressure in the vacuum chamber (22);
- b) the servo unit (30) is actuated; and/or
- c) the pressure in the vacuum chamber (22) is lower than the minimal possible pressure in the electric suction pump (28) plus a threshold value.

Claims

1. A method for monitoring a vacuum device of a pneumatically operated servo unit of a motor vehicle, in which an electric suction pump (28) exerts vacuum on a vacuum chamber (22), characterized in that
 - a) a starting pressure in the vacuum chamber (22) is determined;
 - b) after a predetermined time interval, an ending pressure in the vacuum chamber (22) is determined;
 - c) the difference between the ending pressure and the starting pressure is calculated and is compared to a limit value;
 - d) when this difference falls below the limit value, a signal is generated.
2. The method according to claim 1, characterized in that the limit value is determined as a function of the starting pressure in the vacuum chamber (22).
3. The method according to claim 1, characterized in that the limit value is determined as a function of the ambient pressure.
4. The method according to claim 2, characterized in that the limit value is determined as a function of the difference between the ambient pressure and starting pressure.
5. The method according to claim 1, characterized in that the starting pressure is determined as soon as the suction pump (28) is switched on.
6. The method according to claim 1, characterized in that the signal generated triggers a control or alarm device.

7. The method according to claim 6, characterized in that the triggering of the control or alarm signal is suppressed if at least one of the following conditions is fulfilled:

- a) the pressure in an intake tube (12) of an internal combustion engine, which intake tube is connected to the vacuum chamber (22), is lower than the pressure in the vacuum chamber (22);
- b) the servo unit (30) is actuated; and/or
- c) the pressure in the vacuum chamber (22) is lower than the minimal possible pressure in the electric suction pump (28) plus a threshold value.

8. A computer program, characterized in that it is suitable for executing the method according to claim 1 when it is run on a computer.

9. The computer program according to claim 8, characterized in that it is stored in a memory, in particular a flash memory.

10. An apparatus for monitoring a vacuum storage device (41) of a pneumatically operated servo unit (30) of a motor vehicle, with a vacuum chamber (22), which is fluid-connected to an electric suction pump (28) and can be acted upon with a vacuum, characterized in that

- a) it detects a starting pressure in the vacuum chamber (22);
- b) after a certain time interval, it detects an ending pressure in the vacuum chamber (22);

- c) it calculates the difference between the ending pressure and the starting pressure and compares this to a limit value; and
- d) when this difference falls below the limit value, it generates a signal.

11. The apparatus according to claim 10, characterized in that it includes:

- a) means (34) for determining the pressure in the vacuum chamber (22);
- b) means (46) for detecting the beginning of an evacuation process;
- c) a timer (54), which determines the time elapsed since the beginning of the evacuation process;
- d) means (52) for storing the starting pressure at the beginning of the evacuation process;
- e) a subtraction circuit (60), which calculates the difference between the starting pressure and the current pressure in the pressure chamber (22);
- f) two set point generators (56, 66), one of which predetermines a time interval and the other of which predetermines a minimal value for the difference between the starting pressure and the current pressure in the pressure chamber (22); and
- g) a comparator (62), which generates a signal if the difference is less than the minimal value after the passage of the time interval.

12. The apparatus according to claim 11, characterized in that the means (46) for detecting the beginning of an evacuation process include a device, which detects a signal edge that represents the response of the pump (28).

13. The apparatus according to claim 10, characterized in that it includes a calculation circuit (64), which is connected on the input side to the means for storing the starting pressure and/or means for detecting the ambient pressure, and in which a function is processed so that the limit value is determined as a function of the starting pressure, the ambient pressure, and/or the difference between the starting pressure and the ambient pressure.

14. The apparatus according to claim 10, characterized in that it has a signal generator (68), which triggers a control and/or alarm signal when the signal is generated by the comparator (62).

15. The apparatus according to claim 14, characterized in that it includes means (70), which suppress the generation of a control or alarm signal if at least one of the following conditions is fulfilled:

- a) the pressure in an intake tube (12) of an internal combustion engine (10), which intake tube is connected to the vacuum chamber (22), is lower than the pressure in the vacuum chamber (22);
- b) the servo unit (30) is actuated; and/or
- c) the pressure in the vacuum chamber (22) is lower than the minimal possible pressure in the electric suction pump (28) plus a threshold value.